What is claimed is:

1. A method for controlling materials quality in a rolling, forging, or leveling process, the method comprising:

conducting, at least once, each of the heating step of heating a metallic material, the processing step of rolling, forging, or leveling the metallic material, and the cooling step of cooling the metallic material; and

prior to manufacture of a metallic product of a desired size and shape, measuring qualitative data of the metallic material at a position by means of a materials quality sensor installed in a manufacturing line, and then in accordance with the measured data, making modifications to heating, processing, or cooling conditions in at least one of the steps upstream with respect to the materials quality sensor so that the quality of the metallic material at the measuring position agrees with target data.

2. A method for controlling materials quality in a rolling, forging, or leveling process, the method comprising:

conducting, at least once, each of the heating step of heating a metallic material, the processing step of rolling, forging, or leveling the metallic material, and the cooling step of cooling the metallic material; and

prior to manufacture of a metallic product of a desired size and shape, measuring qualitative data of the metallic material at a position by means of a materials quality sensor installed in a manufacturing line, comparing the measured data with metallic material quality data estimates at the measuring position that have been calculated from actual heating conditions, processing conditions, and cooling conditions of the metallic material by use of a materials quality model, modifying the materials quality model in accordance with the comparison results, and determining subsequent heating conditions, processing conditions, and cooling conditions of the metallic material in the respective steps, by use of the modified materials quality model.

3. A method for controlling materials quality in a rolling, forging, or leveling process, the method comprising:

conducting, at least once, each of the heating step of heating a metallic material, the processing step of rolling, forging, or leveling the metallic material, and the cooling step of cooling the metallic material; and

prior to manufacture of a metallic product of a desired size and shape, measuring qualitative data of the metallic material by means of a materials quality sensor installed in a manufacturing line, and then in accordance

with the measured data, conducting calculations on heating,
processing, or cooling conditions of the metallic material
in at least one of the steps downstream with respect to the
materials quality sensor by means of a materials quality
model so that the quality of the metallic material at a
materials quality control point provided in any position
downstream with respect to the materials quality sensor
will agree with target data.

4. A method for controlling materials quality in a
rolling, forging, or leveling process, the method
comprising:

conducting, at least once, each of the heating step
of heating a metallic material, the processing step of
rolling, forging, or leveling the metallic material, and
the cooling step of cooling the metallic material; and

prior to manufacture of a metallic product of a
desired size and shape, measuring qualitative data of the
metallic material by means of a materials quality sensor
installed in a manufacturing line, and then in accordance
with measured data, making modifications to heating,
processing, or cooling conditions of the metallic material
in at least one of the steps downstream with respect to the
materials quality sensor by means of a materials quality
model so that the quality of the metallic material at a
materials quality control point provided in any position

downstream with respect to the materials quality sensor will agree with target data.

5. The rolling process materials quality control method according to any one of claims 1 to 4, wherein the manufacturing line comprises a water-cooling site at immediate rear of a processing site which uses a rolling mill, and wherein the manufacturing line further comprises a materials quality sensor both or either of two locations, one being between the processing site and the cooling site, and the other being an outlet of the cooling site.

6. The materials quality control method according to any one of claims 1 to 5, wherein the materials quality sensor comprises ultrasonic wave transmitting means, ultrasonic wave receiving means, and signal processing means, the materials quality sensor detecting the quality of the metallic material on the basis of propagation characteristics of an ultrasonic wave within the material.

7. The materials quality control method according to claim 6, wherein the material quality data detected by the materials quality sensor is a crystal grain size of a crystal-containing metallic material present on an ultrasonic wave propagation route.

8. The materials quality control method according to claim 7, wherein the ultrasonic wave transmitting means generates an ultrasonic wave by irradiating the surface of

the metallic material with pulsed laser light.

9. The materials quality control method according to claim 7, wherein the ultrasonic wave receiving means detects ultrasonic vibration of the surface of the metallic material on the basis of a phase difference between the laser light irradiated onto the metallic material surface, and a reflected beam of the irradiated light.

10. The materials quality control method according to any one of claims 1 to 9, wherein the heating step is heating the material by induction heating.

11. The materials quality control method according to any one of claims 1 to 10, wherein the metallic material is either an iron-containing alloy, an aluminum-containing alloy, a copper-containing alloy, or a titanium-containing alloy.

12. The materials quality control method according to any one of claims 1 to 9, wherein the heating step is allowing an induction heater to heat an iron-and-steel material.

13. An apparatus for controlling materials quality in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a metallic product of a desired size and shape, wherein, in accordance with information on a size and shape of the metallic material, on a target size and shape of the product, and on composition and other factors of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings on the heating means, the processing means, and the cooling means;

a heating controller, a processing controller, and a cooling controller which control a heater, a processor, and a cooler, respectively, on the basis of the data settings;

a materials quality sensor installed in the manufacturing line in order to measure qualitative data of the metallic material; and

heating correction means, processing correction means, and cooling correction means, each of which, to ensure that the data measured by the materials quality sensor will agree with target data, corrects the data settings output from the data settings calculation means to the heating means, processing means, and cooling means disposed upstream with respect to the materials quality sensor.

14. An apparatus for controlling materials quality

in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a metallic product of a desired size and shape, wherein, in accordance with information on a size and shape of the metallic material, on a target size and shape of the product, and on composition and other factors of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings on the heating means, the processing means, and the cooling means;

a heating controller, a processing controller, and a cooling controller which control a heater, a processor, and a cooler, respectively, on the basis of the data settings;

a materials quality sensor installed in the manufacturing line in order to measure, at a position, qualitative data of the metallic material;

materials quality model computing means for estimating, by means of a materials quality model, the quality of the metallic material at the measuring position from actual heating conditions, processing conditions, and

cooling conditions of the metallic material;

materials quality model learning means for conducting comparisons between data measurements by the materials quality sensor and arithmetic results by the materials quality model computing means, and learning an error of the materials quality model; and

materials quality model correction means for correcting the materials quality model by correcting the arithmetic results of the materials quality model computing means in accordance with the learning results obtained by the materials quality model learning means;

wherein the data settings calculation means calculates and outputs data settings on each of the heating means, the processing means, and the cooling means, in accordance with the as-corrected-material quality data estimates that the materials quality model correction means outputs.

15. An apparatus for controlling materials quality in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a metallic product of

a desired size and shape, wherein, in accordance with information on a size and shape of the metallic material, on a target size and shape of the product, and on composition and other factors of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings on the heating means, the processing means, and the cooling means;

a heating controller, a processing controller, and a cooling controller which controls a heater, a processor, and a cooler, respectively, on the basis of the data settings;

a materials quality sensor installed in the manufacturing line in order to measure qualitative data of the metallic material; and

materials quality model computing means for estimating, by means of a materials quality model, the quality of the metallic material at a materials quality control point provided in any position downstream with respect to the materials quality sensor;

wherein the data settings calculation means calculates and outputs data settings on each of the heating means, the processing means, and the cooling means so that arithmetic results by the materials quality model computing means will agree with the target data given from the host

computer.

16. An apparatus for controlling materials quality in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a metallic product of a desired size and shape, wherein, in accordance with information on a size and shape of the metallic material, on a target size and shape of the product, and on composition and other factors of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings on the heating means, the processing means, and the cooling means; and

a heating controller, a processing controller, and a cooling controller which control a heater, a processor, and a cooler, respectively, on the basis of the data settings;

a materials quality sensor installed in a manufacturing line in order to measure qualitative data of the metallic material; and

heating correction means, processing correction means, and cooling correction means, each of which, to

ensure that the quality of the material at a materials quality control point provided in any position downstream with respect to the materials quality sensor will agree with the target data given from the host computer, correct the data settings output from the data settings calculation means to the heating means, processing means, and cooling means disposed downstream with respect to the materials quality sensor.